

# THE MINERAL INDUSTRY OF GHANA

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The Republic of Ghana, which is located in western Africa, is bordered on the south by the Gulf of Guinea, on the north by Burkina Faso, on the west by Côte d'Ivoire, and on the east by Togo. The country's 21.1 million inhabitants shared an area of about 238,500 square kilometers (km<sup>2</sup>) (World Bank Group, The, 2005§<sup>1</sup>). In 2004, the real gross domestic product (GDP) growth was estimated to be 5.8% and was projected to increase to 5.9% in 2005 (Organisation for Economic Co-operation and Development, 2005, p. 254). The GDP based on purchasing power parity was estimated to be about \$50.4 billion in 2004; the per capita GDP based on purchasing power parity was estimated to be about \$2,475 for the same period (International Monetary Fund, 2005§, p. 5). Ghana's economy was primarily agricultural. The World Bank, through the International Finance Corporation (2006§), estimated that mining accounted for about 5% of the country's GDP, 30% of exports, and 3% to 4% of Government fiscal revenues and that gold production accounted for about 95% of total mining export proceeds. Mineral commodities produced in the country were aluminum, bauxite, diamond, gold, manganese, natural gas, petroleum, salt, and silver.

## Government Policy and Legislation

The overall legislative framework for the mining sector in Ghana is provided by the Minerals and Mining Law of 1986, as amended by the Minerals and Mining (Amendment) Act of 1994; the Minerals Commission Law of 1986; and the Small-Scale Gold Mining Law of 1989. Under the Minerals and Mining Law, mining companies must pay royalties of no less than 3% of their gross revenues and, depending upon their profitability rate, up to 12%; companies may also pay corporate taxes at standard rates. Companies are exempt from custom duties on accessories, equipment, machinery, and plants used for mining operations, but must pay local property taxes on their immovable properties. In 2004, the Government launched the Extractive Industries Transparency Initiative, which was aimed at ensuring transparency among mining companies conducting operations in the country (International Monetary Fund, 2004, p. 29-32; Republic of Ghana, 2004§). The Ministry of Mines and Energy oversees all aspects of Ghana's minerals sector and is the entity responsible for granting mining and exploration licenses. Ghana National Petroleum Corp. (GNPC) was the Government entity responsible for petroleum exploration and production.

The Government continued to pursue public sector reforms. As part of the reforms, it converted a portion of the Tema Oil Refinery (TOR) debt into TOR bonds and put in place an automatic adjustment formula for petroleum prices. An independent National Petroleum Board was given the authority to adjust petroleum prices. As a Government-owned enterprise, TOR had not been allowed in the past to charge competitive prices for its petroleum products (Organisation for Economic Co-operation and Development, 2005, p. 262).

The European Union, under the Mining Sector Support Program, was to invest about \$25 million to help Ghana's Geological Survey conduct airborne geophysical surveys and mapping. The program was aimed at identifying mineral resources other than gold within the country (Africa Mining Intelligence, 2004b; allAfrica.com, 2004a§).

## Environmental Issues

The Ghanaian Environmental Protection Agency, which was established in 1994 through Act 490, is the Government entity responsible for the formulation of policies on all aspects of the environment. The agency's functions include making recommendations to the Government for the protection of the environment; coordinating the activities of bodies concerned with the technical aspects of the environment for the purpose of controlling the generation, treatment, storage, transportation, and disposal of industrial waste; securing the control and prevention of discharge waste into the environment; protecting and improving the quality of the environment; collaborating with foreign and international agencies as necessary; issuing environmental permits and pollution abatement notices; prescribing standards and guidelines related to the pollution of air, water, and land; ensuring compliance with environmental impact assessment procedures; acting in liaison and cooperating with other Government agencies; and conducting investigations into environmental issues among several other functions (Environmental Protection Agency, 2006, p. 3-4).

Ghana's Obuasi region is known to host arsenopyritic gold-bearing ore bodies. According to company reports, during the 1990s, an arsenic precipitation plant was installed at the Pompora Treatment Plant for the commercial recovery of arsenic from the roaster flue gases. At the time, the recovered arsenic trioxide was sold to Europe for commercial applications. As the market for arsenic declined, the treatment plant was shut down in 2000 and about 10,000 metric tons (t) of arsenic was stockpiled in bags at Obuasi. After the introduction of the Biox treatment process, the arsenic trioxide was converted to arsenic pentoxide and deposited in tailings dams. AngloGold Ashanti Ltd. (the company that was formed through the merger of Ashanti Goldfields Ltd. and AngloGold Ltd.) reported that inadequate storage of the stockpiled bags allegedly caused arsenic contamination to the Pompora stream. The problem was identified during the company's due diligence study prior to the merger. AngloGold Ashanti constructed a lined storage dam at the old heap leach site. The company planned to move the arsenic to a new facility where it will be stored and gradually disposed of by

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<sup>1</sup>References that include a section mark (§) are found in the Internet References Cited Section.

blending it into the Biox process circuit where it will be chemically stabilized and deposited as a component of the tailings residue in the new Sansu Tailings Storage Facility. The company estimates that it will take about 6 years to dispose of the arsenic (AngloGold Ashanti Ltd., 2005§).

## Trade

According to the U.S. Census Bureau, Ghana's exports to the United States were valued at about \$145 million in 2004 compared with about \$82 million in 2003; \$47.8 million of these exports was from petroleum products; \$18.3 million, crude petroleum; \$3.34 million, aluminum and bauxite; and \$163,000, gem-quality diamond (U.S. Census Bureau, 2005b§). Imports from the United States were valued at about \$310 million in 2004 compared with about \$209 million in 2003. These included nearly \$24 million for excavating machinery; \$9.9 million for petroleum; \$2.2 million for drilling and oilfield equipment; and \$539,000 for petroleum products (U.S. Census Bureau, 2005a§).

## Commodity Review

### Metals

**Aluminum and Bauxite and Alumina.**—The Government of Ghana acquired Kaiser Aluminum Corp.'s 90% interest in Volta Aluminum Company Ltd. (Valco) in 2004. Alcoa Inc. of the United States held the remaining 10% interest in Valco. The Government planned to sell some of its acquired equity interest in the company to an interested partner and to create an integrated aluminum industry that could supply bauxite to the 200,000-metric-ton-per-year (t/yr) Valco smelter, which is located in Tema. Kaiser had closed the Valco plant in 2003 after struggling with fluctuating operating levels for several years and dealing with restricted power allocations from the Volta River Authority (Coakley, 2003, p. 17.2; Kaiser Aluminum Corp., 2004; Mining Journal, 2004; Mining Review Africa, 2004).

BHP Billiton p.l.c. applied for a prospecting license to explore the Kibi and the Nyinahin bauxite deposits in the Ashanti and eastern regions. Granting of the licenses was contingent upon BHP conducting an environmental impact study of the areas; the study must be approved by Ghana's Environmental Protection Agency (Africa Mining Intelligence, 2004a).

**Gold.**—AngloGold Ashanti operated the Bibiani open pit mine; the Iduapriem open pit mine; and the Obuasi Mine, which comprised both surface and underground operations. In 2004, gold production at the Obuasi Mine was hindered by intermittent unplanned mill shutdowns and mechanical failures. Total gold production at Obuasi for the eight months of May through December 2004 was 7,931 kilograms (kg) (reported as 255,000 troy ounces). In terms of growth prospects, the company planned to develop the deep-level ore deposits at Obuasi known as the Obuasi Deeps, which are expected to extend the project's mine life beyond 2040. The development of Obuasi Deeps will require an initial investment of \$44 million during the next 5 years to conduct further exploration and feasibility studies. The total capital expenditures for the development of the Obuasi Deeps was estimated to be about \$570 million (African Mining, 2004b; AngloGold Ashanti Ltd., 2005, p. 37).

At the Bibiani Mine, the company faced geotechnical problems at the main pit and mechanical problems at the mill and crushing circuit, which resulted in the unplanned processing of stockpiled material and lower than expected gold production. As a result, a total of 3,266 kg (reported as 105,000 troy ounces) was produced during the eight months of May through December 2004. The mine, which had operated between 1903 and 1968 as an underground mine, was reopened in 1998 as an open pit mine with a carbon-in-leach (CIL) plant. The mine included old tailings dumps, which were reclaimed in December 2004. The tailings were expected to yield about 4.7 million metric tons (Mt) at an estimated recovery grade of 0.60 gram per metric ton (g/t) gold over a period of 3 years. The company expected production at Bibiani to decrease to about 3,141 kg (reported as 101,000 troy ounces) in 2005 owing to the mining of smaller satellite pits and the processing of stockpiled material and old tailings. At the Iduapriem Mine, gold production for the eight months of May through December 2004 in which Iduapriem was part of AngloGold Ashanti was 4,572 kg (reported as 147,000 troy ounces). AngloGold Ashanti held an 80% interest in the Iduapriem Mine; the remaining 20% was held by the International Finance Corporation (AngloGold Ashanti Ltd., 2005, p. 38-39).

Golden Star Resources Ltd. commissioned its Wassa Mine in 2004. The mine, which is located about 150 kilometers (km) west of Accra, was owned by Golden Star (90%) and the Government of Ghana (10%). The mine had been in operation as an open pit heap-leach mine in the 1990s but was closed in 2001. Golden Star acquired the mine in 2002 after determining that conventional CIL processing was economically feasible. The construction of the 10,000-metric-tons-per-day (t/d) CIL processing plant was completed in late 2004. New open pit mining operations began in November 2004. The mine was expected to produce on average about 4,350 kilograms per year (kg/yr) of gold. As of December 31, 2004, total probable mineral reserves at Wassa were reported to be 19.3 Mt at a grade of 1.31 g/t gold, or about 25,000 kg of contained gold (Golden Star Resources Ltd., 2005, p. 6, 14-17).

In addition to the Wassa Mine, Golden Star operated the Bogoso/Prestea (or Bogosu/Prestea as it was previously known) open pit mine, which is located about 300 km west of Accra. Golden Star held a 90% interest in the property, and the Government of Ghana held the remaining 10%. All ore from the Bogoso and the Prestea pits was carried by truck to the 1.5 million-metric-ton-per-year (Mt/yr) Bogoso processing plant. The company planned to increase capacity at the plant to 3.5 Mt/yr by late 2006. As of December 31, 2004, total proven and probable mineral reserves at Bogoso/Prestea were reported to be 30.9 Mt at a grade of 2.83 g/t gold. In addition to the Bogoso and the Wassa processing plants, Golden Star planned to commission a third plant at Prestea. The plant, which will be known as the Bondaye plant, was acquired from Resolute Mining in 2003 for \$4.3 million. Once refurbished and brought online, the plant is expected to produce about 3,700 kg/yr of gold. Golden Star was considering reopening the Prestea underground

mine, if feasible. The company planned to spend \$6.6 million of the \$21 million that it had allocated for exploration in 2004 on the Prestea underground mine (African Mining, 2004a; Golden Star Resources Ltd., 2005, p. 9-10).

Newmont Mining Corp. of the United States continued to develop its Ahafo and Akyem properties. The Ahafo property, which is located about 300 km northwest of Accra between the towns of Kenyase and Ntotroso, comprised 11 ore bodies. The Akyem property is located in Ghana's eastern region about 130 km northwest of Accra between the towns of New Abirem and Ntronang. In 2004, Newmont increased its tenement area in the Akyem District by 1,536 km<sup>2</sup>. (Newmont Mining Corp., 2004\$).

According to Gold Fields Ltd., the Tarkwa open pit mine reached record production in 2004 by processing about 16 Mt of ore and produced 17,107 kg of gold. During the year, the company reported that it had completed about 91% of the construction of the new 4.2 Mt/yr mill and CIL plant and spent about \$78 million of the \$85 million assigned to the project. At the Damang Mine, Gold Fields reported that ongoing optimization of the mill feed blend and plant setup allowed for the treatment of almost 5% more tonnage than that of 2003, which resulted in the production of 9,589 kg of gold (Gold Fields Ltd., 2005\$).

### ***Industrial Minerals***

**Cement.**—Ghana Cement Works Ltd. (Ghacem), which was controlled by Heidelberg Zement AG of Germany, operated Ghana's two clinker-grinding plants at the port cities of Takoradi and Tema. The capacity of each plant was 1.2 Mt/yr. In 2004, Ghacem acquired a mining license to develop a limestone deposit located in the country's eastern region. The company was to invest \$2 million to produce limestone locally. Ghacem used imported clinker, gypsum, and limestone for the manufacturing of cement. By producing limestone locally, the country will reduce its dependence on imported limestone and clinker to supply its two cement plants (Aggregate Research Industries, 2004\$; allAfrica.com, 2004b\$; Ghana web, 2004\$).

### ***Mineral Fuels***

In October 2004, Oil and Natural Gas Corporation (ONGC) Videsh Limited of India signed a Memorandum of Understanding with GNPC to establish bilateral cooperation in petroleum exploration and production (ONGC Videsh Limited, 2004\$).

Between April and October 2004, land acquisition negotiations and compensation agreements for the West African Gas Pipeline (WAGP) were completed in Benin, Ghana, and Nigeria. Negotiations with Togolese landowners were ongoing during the year. Engineering, procurement, and construction contracts were awarded in December 2004 (West African Gas Pipeline Company Limited, 2005\$). In November, the World Bank approved \$125 million in guarantees to support the construction of the WAGP. The Multilateral Investment Guarantee Agency provided \$75 million, which represented 90% of the equity investment of \$83.4 million in Ghana by the West African Gas Pipeline Company Limited to insure against a breach of contract. The International Development Association provided \$50 million for 22 years. As of November 2004, the total cost of the WAGP was estimated to be \$590 million (World Bank Group, The, 2004\$).

The Government planned to construct a \$40.2 million petroleum products pipeline at Buie in Ghana's northern region. The pipeline will transport diesel, gasoline, kerosene, and petroleum products 275 km through an 8-inch-diameter pipeline from Buie in the northern region to Bolgatanga in the eastern region. The Government of Korea will finance \$38.2 million, and the Government of Ghana will finance the remaining \$2 million. The pipeline was expected to be completed by November 2005 (Alexander's Gas & Oil Connections, 2004\$).

### ***Infrastructure***

The International Finance Corporation planned to invest \$60 million in the Takoradi powerplant to increase capacity to 330 MW from 220 MW. The powerplant was 90% owned by CMS Energy and 10% by the Ghanaian Government through the Volta River Authority. After construction of the WAGP, the plant would be fueled by natural gas instead of petroleum (Africa Energy Intelligence, 2004).

Plans were underway to construct a railway line to link the city of Ouagadougou in Burkina Faso to the Boankra inland port in Kumasi, Ghana. The proposed railway line would provide an alternative route to Ghana's Atlantic ports, bypassing Côte d'Ivoire, and would cost about \$750 million. The African Development Bank had secured \$5.4 million for a feasibility study. Until the advent of the civil war in Côte d'Ivoire, the railway line to the Abidjan Port was used by Burkina Faso, Mali, and Niger for their external trade. Since then, the three countries have had to divert their trade to other ports in West Africa, such as to the Takoradi and the Tema Ports in Ghana. Transit trade through the Tema Port was estimated to have increased to more than 700,000 t in 2003 from 20,000 t in 1999, which has affected traffic flow on Ghana's north-south highway from Tema to Paga (OT Africa Line, 2004\$; Reuters, 2004\$).

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TABLE 1  
GHANA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

(Thousand metric tons unless otherwise specified)

Commodity <sup>2</sup>	2000	2001	2002	2003	2004 <sup>c</sup>
Aluminum:					
Bauxite, gross weight	504	678	684	495	498 <sup>5</sup>
Metal, smelter, primary	137	144	117	16	--
Cement, hydraulic <sup>3</sup>	1,950	1,900	1,900	1,900	1,900
Diamond:					
Gem <sup>c</sup> thousand carats	700	936	770	724	725
Industrial <sup>c</sup> do.	178	234	193	180	180
Total <sup>4</sup> do.	878	1,170	963	904 <sup>r</sup>	905 <sup>5</sup>
Gold <sup>6</sup> kilograms	72,080	68,341	69,271	70,749 <sup>r, 5</sup>	63,139 <sup>5</sup>
Manganese:					
Ore, processed	896	1,077	1,136	1,509	1,597 <sup>5</sup>
Mn content <sup>c</sup>	287	344	363	528 <sup>r</sup>	559 <sup>5</sup>
Natural gas million cubic meters	--	--	--	112	112
Petroleum:					
Crude thousand 42-gallon barrels	2,555	3,285	2,555	3,000 <sup>e</sup>	3,000
Refinery products: <sup>c</sup>					
Liquefied petroleum gas do.	-- <sup>5</sup>	-- <sup>5</sup>	625	625	625
Gasoline do.	2,190 <sup>5</sup>	2,445 <sup>5</sup>	5,850	5,850	5,850
Jet fuel do.	730 <sup>5</sup>	511 <sup>5</sup>	625	625	625
Kerosene do.	365 <sup>5</sup>	767 <sup>5</sup>	1,950	1,950	1,950
Distillate fuel oil do.	2,555 <sup>5</sup>	2,628 <sup>5</sup>	4,450	4,450	4,450
Residual fuel oil do.	1,825 <sup>5</sup>	1,862 <sup>5</sup>	1,250	1,250	1,250
Other including refinery fuel and losses do.	730 <sup>5</sup>	767 <sup>5</sup>	1,250	1,250	1,250
Total do.	8,390 <sup>5</sup>	8,980 <sup>5</sup>	16,000	16,000	16,000
Salt <sup>c</sup>	150	68	99	250	265 <sup>5</sup>
Silver, content of exported dore kilograms	6,101	1,945	2,129	3,379 <sup>r, 5</sup>	3,329 <sup>5</sup>
Steel, secondary, rebar <sup>c</sup>	75	75	75	75	75

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through November 2005.

<sup>2</sup>In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) are produced, as are limestone and lime for the processing of some gold ore and salt. Output of these commodities is not reported and information is inadequate to make reliable estimates of output levels.

<sup>3</sup>All from imported clinker.

<sup>4</sup>Production, in thousand carats, includes that of Akwatia Mine: 2000--233; 2001--300 (estimated); 2002--268, and 2003--240 (estimated). Remainder are artisanal sales to the Precious Metals Marketing Corporation. Estimates of unreported artisanal production are not included.

<sup>5</sup>Reported figure.

<sup>6</sup>Does not include estimate of smuggled or undocumented production.

Sources: Ghana Minerals Commission and company reports.